

AE. OCHALINOS.

OR,

A Register for the Air;

IN

FIVE CHAPTERS.

1. Of Fermentation.

2. Of Chylification.

3. Of Respiration.

4. Of Sanguification.

5. That often changing the Air, is a friend to health. Also a discovery of a new method of doing it, without removing from one place to another, by means of a Domicil, or Air-Chamber, fitted to that purpose.

For the better preservation of Health,
and cure of Diseases, after a new Method.

By NATHANIEL HENSHAW, M.D.
a Member of the Royal Society at
GRESHAM-COLLEDGE.

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seller in Castle-street, 1664.



To the Right Honourable
Thomas Earl of Ossery, Lord Deputy
General of IRELAND, &c.

Right Honorable;

That the happy Industry of former Ages (whereby we enjoy the benefit of so many useful inventions) hath still left mater enough, for the contrivance and discovery of succeeding times, cannot be better made appear, than by calling to mind, those many worthy improvements, which almost all the more Liberal Arts, have received within the compass of this last Century, especially Physick, wherein Anatomy alone (I may truly say) hath been enriched, by a full third part at least. And herein our own Countrymen, have been as successfully inquisitive, as any other their Contemporaries whatsoever. No wonder then if in such an Age, I, imitating their example, have thought fit, to give this account, of my leisure, to the world; but

that I offer it to the protection of so great a Patron; the reasons, perhaps, are not so manifest, as necessary. For as the Novelty of so unexpected a method, as I here propose, will undoubtedly expose it to the calumny of such, who (rather than give themselves the trouble of examining the truth of it, being betimes perswaded, that they already know as much as is to be learnt) will soon condemn it, both of folly and innovation. So it seems of absolute necessity, that it bear with it the splendid name of some great Personage, the better to bespeak the judicious Readers charitable Censure. Whose name then could I more hopefully have prefixed, than that of your Lordships, a person so Noble by descent, so Eminent by your Great and Honorable Employments, and so deservedly beloved and admired of all for that excellent composure of Greatness and Goodness, so remarkable in your Lordship; which attempt of mine, if it may receive a favourable Interpretation, I shall be obliged to continue

Dublin, July


1. 1664.

Your Honors in all

Submission, &c.

N. H.

The



The Preface.

I Hold it not unsuitable to our design in this Treatise (where I have so often occasion to make mention of it) that something be said by way of Preface, concerning the Air. Not that I intend to treat of it's first or second qualities, &c. Which I leave to the natural Philosophers consideration, much less of the Elastic power of it, in Pneumatick Engines; already so well performed by others, especially by the Honorable Robert Boyle, in his most accurate Treatise on that Subject: my purpose here being only to present my Reader, with some few observables concerning Air, the better to confirm and illustrate, what follows in the Treatise it self: especially in the Chapter of Fermentation. First therefore, that the Air is of some very general use, may well appear from its being so great in Ubiquitarian, as it is. No place almost without it, no body (perhaps) but participating, more or less, of it in so much, that

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even in metals themselves, the sound of them, is reckoned an affection of the Air included in them. And if the transparency of Bodies be to be imputed to their porousness, or rather to the streightness or rectitude of their pores, (as its almost generally agreed on by Modern Writers) it will follow, that there is a great proportion of Air in the hardest Gemmes. Which is yet more manifest in softer stones, and becomes the cause of their mouldring and cracking (after they are taken out of the Quarrey, and exposed to the weather) which some sort of stones are very subject to: For the imprisoned Air, that while it was in the cold bowels of the Earth, lay very much condensed or compressed, afterward symbolizing with the Air of a thinner Medium, powerfully dilates its self, and after some time so weakens the continuuity of parts, that at last becoming too strong for it, the stone breaks into many pieces, which will sooner happen if the same be thrown into the fire: the included Air, in such case, with much more violence dilating its self, than in the former experiment. Plants seem to owe their very life and being to this included Air: for not having hearts, or other principal of motion in them,

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them, (that we know of) for the distributing of the Sap: the included Air seems to supply that defect, after this manner. In the day time, in hot weather, and generally as often as the Air of the Medium, is dilated or contracted: the Air included, in the body of every Vegetable, suffers after the same manner, and has its dimensions and tone varied. Whereupon these two considerable effects follow, to wit, that upon the dilatation of the internal or included Air, the parts of the Vegetable are distended (somewhat) according to their trinal dimension, whereby the Plant grows bigger and taller. And again, upon the compression of the internal Air, room is made for the water or Sap, to rise up, through the pores of the Plant, exactly after the manner of the Weather-glass: where the compression of the Air becomes the cause of the ascent of the water. And thus according to these periods of heat and cold, and the consequent rarity and density of the included Air, and that of the Medium: every Plant makes, as it were, so many meals, or is so often refreshed, by the ascending Sap, which ascent is also not a little promoted, by those gentle Vibrations from the winds, whereby the parts of Vegetables (and consequently

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the included Air) are moderately compressed and dilated reciprocally; wherrupon the fore-said effects follow, even after the same manner, as is said of the Swing, and in the last Chapter of this Treatise. The included Air serves likewise in Vegetables (as in all other bodiet) for the maturing and fermenting the juices in them, in such manner as is hereafter expressed. A farther confirmation whereof may be hence had, that the most vegetous plants, and such as we call Ever-Greens, abound most with Air in them: as appears when they are thrown into the fire, by the violent eruption of it. And there is, I think, no vegetable that has not one great pore or Pipe running from the root to the very top of it. Farther, in the Sea wrack, or Quercus Marina, tis obvious for every one to observe a very particular and curious contrivance of Nature, for the nourishment of that plant, by the help of Air after this sort. The plant is always fastened to some stone; and as it branches out, with jagged leafts, somewhat resembling those of the Oak: it hath several little Blisters or Bladders on it. (Some whereof I have seen as big as a small Pullets Egg.) Now upon the coming in of the Tide, the water

rising

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rising this weed by means of the said Bladders floats; and if the Stone be not too heavy Boys it up. (and hangs in the water like a Net that hath Corks and Leads to it) whereupon the Plant is considerably stretched; and again, upon the subsiding of the water, receives its nourishment, as in the former instance of other vegetables, though perhaps not from the root, being fastened to a stone, but by the porous surface of its body. And lastly, that there is much Air disseminated through the bodies of Animals, is manifest from their food: herbs and water, both which participate of it in good quantity. A notable argument whereof is water, may be, that it doth upon such easeterons rise up in a vapour, and mingle its minute and insensible parts with the Air. For as the water grows warm, either by the heat of the Sun or fire, the small parts of Air dilating, make haste to the top of the water, where they frame themselves, with some of the water, into little bubbles; and are carried away by the motion of the Air or Medium, like those bubbles made by Children, with soap and water. And this perhaps may be one reason, why Rain water is better for plants, then other water, because it has more air in it; a testimony

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quently whereof the Scale may afford us. And this is manifest in wine even to sense: from which (if it be brisk and fresh, and poured from on high, into a glass) you shall first see a great number of little bubbles, or floating parcels of Air rise up, with such force, as to mount neer a foot, above the surface of the wine. But it is not enough for us to have proved great quantities of Air in all mixed bodies, unless it be at the same time allowed us, that the Air be actually and formally there as in the Medium or open Air, suffering nothing else but barely an imprisonment, or confinement only, which is already sufficiently made out by the uses lately assigned it in vegetables, (unless they may be otherways more commodiously explained) besides, that the possibility of converting one substance into another, was yet never so clearly taught, as to become intelligible, and has at this day but few Asserters of it.


In contemplation of all which particulars, and that the Air alone, of all Simple Bodies is capable of dilatation and constriction (or call it rarity and density) yet, not by any power to move it has of its self, but as it is moved more or less, by the presence or absence, the

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the nearness or remoteness of the Sun (the heart and Center of this worldly System in which we live) I thought it a matter worth my pains (though perhaps exceeding my abilities) to assay whether all fermentation, were not reducible to this simple motion of the Air, and did not depend on it, as on a general and more universal cause ; which if I fail not in, it will be no very difficult matter , to reduce all other motions in the world, to that of fermentation, and probably to resolve many hard questions, not as yet so rightly determined. But because contemplations of this kind, are, in their own Nature, very unprofitable, if not reducible to practise : I have, as well as I could, applied the same to the cure and prevention of most diseases : as will somewhat more at large appear by the ensuing Treatise. Which I have suffered to undergo the publick view, with this assurance, that if the foundation I build on, fail me not, I need not at all doubt the Superstructure.

Clarissimi

The Preface



Clarissimi viri Nathan. Henshaw,
M. D. opus hoc mole quidem Ex-
iguum, sed acuminè, eruditione cùm
variâ & jucundâ, tum utili & novâ,
succoque, plenum relegimus; idque cun-
ctis tam Medicinæ non-vulgaris quàm
Secretioris & Solidioris Philosophiæ
Studiosis summoperè commendamus.

JOHANNES STEARNE.

Dat. è Collegio S. &
Individ. Trin.
propter Dubli-
nium Calend. Ju-
lii 1664.

M. & J. V. D. &
M. Professor Pub-
licus in Academiâ
Dublinensi.





CHAP. I.

Of Fermentation in General.

1. **B**Y Fermentation, I understand that motion observable in all compound or mixed bodies whereby the order and situation of all the minute parts of the same, are continually changed, as well in respect of themselves, as of the whole Mass whereof they are parts: and that, chiefly from an internal cause so moving or disposing them, (without the local motion of the whole) whether the same be accompanied with any sensible heat, in the Mass so fermented, or not.

2. That such a motion or fermentation every where observable, we need not go to prove, if we consider, that there is

(2)
scarce any thing sublunary, which is subject to our observation, that continues the least moment of time in the same tenour without alteration, which, if not observable to sense is yet found to be so, with as little reasoning as that the shadow upon the Dial continually moves on, though our eye determine not, till after some minutes, perhaps, of time, it becomes apparent, that the shadow has moved and then we straight conclude it moved all the while: and that the proportionall parts of space, were commensurate to the respective moments, in which the shadow passed from one term to the other: if therefore all bodies are thus moved or fermented at all times, it follows that the Doctrine of Fermentation (according to our acception of the word) is in the manner as far extended as that of Nature it self. I shall only consider it so far as it seems conducive and subservient to those noble ends I have proposed my self in this Treatise, viz. the continuation of health, the cure of Diseases, and the retarding of old Age (to say no more, and not to promise too much) by a new and hitherto unheard of method.

3 The most general properties of fermentation are these: that the Mass so fermented suffers an eminent alteration in all its usual wayes of affecting our senses, as well in its first as second qualities: they are either exalted or depressed, they are sometimes changed for their contrary, and in a word, relation being had to our esteem of things thus fermented, all fermentation may be said to be either perfective or destructive, though in it self it be but one continued flux: as for instance in an apple, or the like, that from a green austere bud, first acquires its due perfection, and after by a continuation of that fermentation, that ripened it, at last arrives at corruption, and so changes both its name and nature together.

4 Another eminent property of fermentation, is that for the most part the Body fermented doth occupy more space than the same did before, which is very evident in the drowned bodies of men or other animals, which though at first they go to the bottom, yet after a certain time do slowly boye themselves up again to the top of the water, not for that the breaking of the

Gall becomes the cause of their ascending : as some even knowing men have suffered themselves to be perswaded :) but because such bodies formerly heavier than water, quantity for quantity, and consequently apt to sink, have now acquired a larger dimension, while they however increase not their weight, and so becoming lighter than the water contained in the like space are protruded by it to the top where they by degrees swell yet bigger, so that sometimes I have seen a dog lye with more than one halfe of his body above the surface of the water, and it is no more than happens in a pound of Glas, metal or other heavy material, which in a solid Mass sinks to the bottom, but if blown or wrought into a bottle, it keeps the top of the water: all which together with the reason is well enough known to such as have been conversant in statick Experiments.

5 Another very useful property of Fermentation is, that while it separates all Heterogeneous parts, it leaves the Basis as it were, or main ingredient of the Mass clear and limpid, if not hindred by the density of the body, and throws off two re-
crements

crements or superfluities, one a heavier descending to the bottom, the other of a lighter more frothy substance, which takes its place at the top of the liquor : as is manifest in Wine, Sider and the juices of other fruits : in Beer made with Barly, and the decoctions of other grains, first, maultee and grown'd. This happens not in Bread, because the greatest part of the Mass being the more solid, the less or watry part takes its flight on all sides to the circumference, though somewhat more slowly, and there coagulates into a blew mould.

6. Another noble property of Fermentation, is, that it exalts the body fermented to what perfection it is capable of, but then it is requisite that the body fermented be of such a consistence, as may not be fermented too fast, as in fruits, upon trees, or if thin, that it be close stop't in some full Vessel, as all kind of drinks : or if of middle consistence, that it be often stirred, which is observed by Apothecaries in the making of Treacle, and other such Compositions, which afterward will keep a very long time. For thus it is necessary, that that spirit (as we will call it for the pre-

sent) which ferments the Mass, be for a while detained either by the tone of the body, by some strong vessel; or that it be often re-effused, as it were, upon its body, that so by its long, difficult and reiterated working, it may at last find out some congruity amongst the less Heterogeneous parts, and cause a kind of complanation of the whole Mass, and it self with less reluctancy, be detained in the Body or Mass.

7. Another very General property of Fermentation is, that all bodies, almost by it, at last become acide: as is manifest in all liquors, decoctions of flesh, or herbs, electuaries, sirups, &c. by which acidity I understand not that sower taste, observable in most green fruits, which is rather to be termed acerbity, and differs as much from what we here speak of, as Agresta (the juyce of green grapes exprest) doth from Vinegar.

8. In the next place, let us briefly consider the causes of Fermentation, the most immediate of which, seems to be the Air, contained in every mixt body: for as I noted before, all bodies fermented, do occupy a larger room, than they did before
fer-

fermentation: which cannot be duely ascribed, to any other ingredient in mixt bodies, than to the air, for that it hath not yet been found, by sufficient experiment, that any body whatsoever is capable of rarification and condensation; or dilation and construction besides air: as for Leaf Gold, what it got in one dimension, it lost in the other, and all the parts of Gold calcined, do but equal the Mass they were made of, no more than if the same had been reduced to an impalpable powder by means of a very fine file. The same is to be understood of water evaporated by heat: which is on'y a comminution of it, into exceeding small parts, and no way a conversion of it into air (as hath been formerly received) which is from hence evidenced, that such vapours by the Alembic, are again reducible to the same liquors from whence they were first raised, viz. into Rosewater or spirit of Wine, which were no more possible, if they had been really converted into air, then out of common air to draw Rosewater or spirit of Wine, and if water, or milke or other liquor take up more room when boyling on the fire, then they did

cold, 'tis by reason that the particles of air, formerly not visible are now considerably dilated, so as to become observable to the eye.

9. As the Air contained in mixt bodies, is the most immediat efficient cause of Fermentation: so it needs, exciting and actuating, for the most part, as well by the temper and tone of the *Medium*, as from the addition, of this or that particular Ferment as of leven yeast, Renet, or the like: of which perhaps we shall have farther occasion to speak more, hereafter, and at present only consider how the *Medium* especially the Ambient Air, excites the internal air in the work of Fermentation.

10. By the Tone of the Air, I understand the measure of its rarity and density and especially its reciprocations or frequent access and recess to this or that degree of rarity and density. Now, that one Air is rarer than another as that of hills, then that of the valleys, that of southern Regions, then that of the more Northern: is I think an undoubted truth: also that the Air of every particular place is sometimes rarer sometimes denser according to the
several

several seasons of the year, times of the day and night, &c. needs no other proof than that of the Weather-glass. By the temperature of the Air, I mean its degree and difference of heat and cold, which admits of the same considerations of place and time as before, and is not only proved by the Weather-glass, but even by sense it self.

11. The manner how the Ambient works upon the internal air in mixed bodies, is the same with that of the Weather-glass, where the inclosed air is rarified, and condensed, heated and cooled accordingly, as the Medium is affected: So in bodies fermented, especially liquors, the imperceptible particles of air being gently and by degrees dilated, become the cause that the whole Mass doth occupy more and more room, or encreases its dimensions under the same weight, whereupon this effect immediately follows, that several Heterogeneous Particles, which before floated in the liquor, and were (as I may say) equilibrous with the same, do now gently descend toward the bottom, in order, according to their weight: The small Particles of air in
the

the mean while being more and more dilated do, together with the more viscous parts of the liquor (of which they form themselves Coats or Integuments) gently ascend to the top of the Mass, where they make that frothy head or scum observable in Sider, Wine, Beer, and other liquors; and this I take to be the natural method of all fermentation when not checked, or otherwise determined by some outward circumstance: And this also seems a genuine reason of the depuration, and of the casting off the heavier and lighter recrement mentioned before (N. 5.) to happen in fermented liquors.

12. That Bodies are ripened and acquire their due perfection by fermentation, is asserted N. 6. but in such case it is necessary, that this fermentation be checked or retarded in such sort as is there mentioned, both in natural and more artificial fermentations: But the most universal Moderator of this motion, is what was lately call'd the tone of Air, as well as its temperature, which daily and hourly changing, doth accelerate, retard, check and put backward this motion, and then restores it again; by which

which various, and oft repeated course, the parts are comminuted, their roughness retarded and mitigated, and they so disposed of, after an inexplicable manner, as conduces most to the beauty and perfection of the Body fermented.

13. This dilatation and constriction in Bodies fermented, caused by the like accidents of the Ambient Air, may not improperly be compared with the pulse in Animals having its *Systole* and *Diastole*, even as they have, though by longer periods, as of day and night, warm weather and cold, &c. and from hence perhaps is the true cause of pulses in Animals to be lookt for, which yet as forreign to our present scope we here enquire not farther after; but it will not be improper to observe (with common experience) that Malt is best made in windy weather, and that the best and most lasting Beer is brewed in *March* and *September*, (windy moneths, and of an unequal temper) Now 'tis evident, that all winds are moved by gusts rather than equal fluxes (from whence probably it is that the Sea is lifted into Waves, as it were numbring to us the several

ral impetuous strokes it received from the
 winds.) Thus the motion of all Animals
 seems to be performed by snatches and
 jerks; and it is indeed a great question a-
 mong School-Philosophers, whether any
 local motion be (strictly speaking) continu-
 al, and not rather consisting of short moti-
 ons, and frequent rests, as it were com-
 pounded together. This Pulse, or frequent
 change in the tone of the Air, however it
 may seem at first view an idle or over-subtil
 contemplation, will upon due considerati-
 on, be found not only true, and the cause of
 those effects assigned to it in the foregoing
 Paragraph, but that it may also with good
 effect be made use of in Physick, as a nota-
 ble instrument for preservation of health,
 and the cure of diseases. I shall hereafter
 endeavour to prove in the ensuing dis-
 course. That most liquors fermented, especi-
 ally in the beginning, conceive heat, and
 become warm, even to sense the reason,
 may be partly gathered out of what has
 been already said; namely, that the small
 particles of Air in such liquor become di-
 lated, which dilatation is always accompa-
 nied with an encrease of heat, they mutu-
 ally

ally making way for, and introducing one the other (in the Air and bodies participating of Air) if not hindered from without; to which may be added, that all motion is apt to beget heat in the Body moved, which is true not only of solid Bodies, though more eminently in them, but also of liquid Bodies themselves. Thus 'tis said in making Butter, you must neither make too much at once, nor yet must it be too violently beaten or shaken, for in such case there will be great hazard of over-heating the Butter, which as you see is the meer effect of motion in a liquid Body only. Besides most liquors fermented, about with a kind of Tartar (which afterwards sublideth when the Mass begins to co the collision of whose rough particles against the other, may perhaps somewhat contribute to the production of this heat though I for my part impute less to them the causes before assigned, though remarkable heat arising in *Aqua fortis* sed upon filings of Iron or Silver, is perhaps best made out by the collision of its aspro parts against those of the said Metals.

14. As concerning particular ferments, I shall

shall only observe, that congenerous Bodies suffer most, and are best fermented by their own proper ferments, namely Ale by yeast, Dough by Leven, Milk by Renet. Thus Apples, Pears and Grapes, and generally all fruit, once corrupted or rotten, do more easily affect and putrifie those of their own kind than of any other; I say more easily, for they will, though with more difficulty, and after a longer time, corrupt fruits of a divers kind also; and those particular Levens before-mentioned, will in like manner (though probably not so naturally) ferment other Bodies of whose kind they are not:

Thus Yest will ferment Dough (which yet is something congenerous to it, as proving it self originally from Corn or Barley;) and whites of Eggs beaten up with snowy froth, will indifferently supply the want of Yest, in either Wort or Dough; I am verily perswaded, that the Yesty froth which may be taken off the top of running Drills of water, would effect the same mingled with Dough, unless perhaps it be not viscous enough, wherein it seems only to differ from the whites of Eggs beaten as is said; and it were worth the

the trying to understand, whether a Mass of Dough made with flower and snow only, would need any other raising or Leven. I have read, that in the Countryes about *Parma* and *Piacenza*, whence those so much valued *Parmisan* Cheeses come, the people make use of Snow instead of Renet. This instance however of the white of an Egg beaten, may serve very well to illustrate our Position concerning the fermentation of Bodies by the dilatation and constriction of its aereous Particles: as also the kneding of Dough, and shaking of liquors (which is a kind of kneding too) the better to make them rise and work, will notably confirm what we said of the Tone of the Air, its frequent alterations, and of windy weather, how much they conduce to the better fermentation of most Bodies.

15. Note, that the reason why the juices of most fruits do soon after expression acquire a strong fermentation, seems to be this, that not only the liquor is now more at liberty, then when mixed with the fleshy parts of the fruit, but likewise that the Airy Particles lay very much compressed in the fruit, every particular Grape, Cherry

Cherry and Apple, being in the nature of a little Bottle, which as we see, if well stoppt, hinders the working of Ale or Wine, but once opened, the liquors straightway ferment and swell very imperuouſly, the compressed Air forcibly dilating it ſelf; and this is the reaſon, that fruit a little eaten by the Birds or Snails, will ripen much faſter than if they had not been entered upon, (but then the taſte will not be altogether ſo generous and ſprightly.) Thus Apples and Pears gather'd green and hoarded, ripen ſooner far, than if they had continued hanging on the Trees, for that they now receive ſome vent at their ſtalks; and I find the Ancients were wont to plant the *Capriſicus* (or wild Fig-tree) neer their other domeſtick Fig-trees, that ſo the Flees which in great quantities are bred out of the fruit of the *Capriſicus*, may ſeize and pierce the Figs of the other trees, as they do in ſeveral places, thereby not only accelerating their time of maturity, but alſo (which perhaps is particular to this kind of fruit) rendring them much more tender and delightful than otherwiſe they would have been, had no ſuch Artifice been made

use of. Now as we have said, this kind of fermentation whereby fruits attain their maturity, bears a very due proportion with that observed in bottled drinks, which if well stopt are slower in ripening (but of better taste) than in open vessels: as also if placed in cold well-vaulted Cellars, then if exposed to the Air: and that for this reason, that the difference of heat and cold (especially in Summer) is by many degrees more in the open Air, than in such subterraneous Vaults, and consequently the Aerous Particles, contained in such fermented liquors, are more dilated and constricted (reciprocally) when exposed to the weather, than if laid up in Cellars, or buried in the ground. Which reciprocation of the tone of Air, we have already asserted to be the principal, if not the only cause of all fermentation. And it may be farther illustrated, by a common practise of bottling up Wine, or other drink, with a lump of Loaf-sugar in it, which will make it much more brisk and lively. And this it doth, not by its sweetness sure, for that were apter to clog and tame it, as is found by practise; or if it did, then Syrup of Sugar, or a small quanti-

ty of powder Sugar, might indifferently produce the same effect: which yet is contradicted by experience. Nay, I dare confidently affirm, that the like quantity of the same Loaf-sugar, first done into very fine powder, will not serve the turn. So that I cannot imagine other reason, why the lump of Loaf-sugar is of that use, put into bottled wine, &c. than that being very porous, it conveys with it self, a great quantity of air into the liquor: and does in effect no more, than what has been already said of the whites of Eggs beaten up together into a froth. So it is not the Sugar, but the air contained in the sugar, which mends the fermentation of the drink, and whereby the Sugar supplies the place of an additional ferment, the better to excite the working of the liquor.

16. And lastly, methinks it might alone serve turn, to convince us of the great efficacy the air hath, and the power it exerciseth on all or most mixed Bodies: what we finde to manifest by experience in preserving of flesh, fruits, the Bodies of Insects, and other the like, whether for aliments or curiosity only, and that with little

tle other preparation many times, than by barely immersing them in wax, oyl, butter, sewet, some Gum or Rosine, &c. and afterward carefully putting them up into Vessels well stopped. By which practise we seem to obtain little else, than that we do hereby, as it were, conceal those Bodies, thus preserved, from the air, which would otherwise, in a short time, have totally corrupted them: their long continuance and preservation seeming to follow, as the consequence of that artificial exclusion of the air, whereby the Bodies (or rather the air in them) are no longer apt to be affected, according to the various dispositions of the Medium.

Farther, it is well worth our Observation, that Chyle, Milk, Cream, the seeds of all Vegetables, and even that of Animals it self, seem to owe their whiteness, to the interspersion or dissemination of air only: even after the same manner, as is already observed in Snow, and some other Bodies.

CHAP. II.

That Chylification is a sort of Fermentation, and how distribution is performed.

I. **T**He Stomack or Ventricle in animals, designed by Nature for the Office of Chylification; commonly called the first Concoction (and which is, as it were, the root of all Vegetation or nutrition in them) seems at first birth but ill fitted for such a work, till the Coats or Membrances thereof, have been well stained or seasoned by the receipt of an aliment so prepared, that it want little more than warmth, to the perfecting of that operation upon it, which is expected from the Stomack. And thus, for all animals that suck, Nature has provided for their first food, a kind of corrupted Milk, usually called Beastings, which gives, as it were, the first tincture to their tender Stomacks, and whereby they seem enabled to concoct more perfect Milk, which

which they begin to draw after a day or two. Which Milk also by degrees becomes more thick and harder of concoction, proportionably to the encrease of strength, in the stomach it self, till by little and little, they begin to alter their diet, and forsake the Teat, for such other food as is most proportionable to their respective Natures.

2. This Tincture, thus imprinted on the Stomack, may very properly be termed a ferment, and seems to bear a just proportion with Leven, which is a small part of the Mass of Dough, suffered to grow lowre, while the rest is converted into bread, which if not hindred, would have all turned into leven likewise. Thus after the Chyle is conveyed from the Stomack into the Guts, from thence to be distributed through the whole Body: some small part that remains sticking to the coats of the Stomack, soon after acquires that acidity, due to all fermentation not interrupted: which after some time begins to grieve and afflict the Stomack with its sharpness: the sense whereof, we usually call hunger: which sense of pain (or hunger) continues to grow more and more, (that which caused

it becoming still sharper and sharper) till by the reception of new aliment, the acidity of the said Tincture or Leven, be so mitigated and allayed, that the Stomack being, as it were, healed by application of these new, benigne, and uncorrupted juices, is no longer sensible of any pain or molestation: which then puts an end to the desire of eating. But if food be forborn, or withheld, the pain so long encreases, till it at last destroys the sense of the part, and introduces a sphacelus, Gangrene or Mortification in the Stomack: which is afterward soon conveyed to the heart and brain, by its communion of Vessels, and so at length becomes the death of the Animal. Which seems rather to be the cause of death, in such as perish by hunger, than the emptiness or inanition of the Vessels, which, though much exhausted, are yet found in such cases, with a considerable quantity of blood in them. Nay, 'tis a frequent practise in the Desarts of *Arabia* (as I am informed by some that have travelled in the Levant) to let their Camels blood after several days fasting, and to give them their own blood to drink, as the last means left

to preserve their lives. Which practise, as it cannot replenish the veins, to that measure it already emptied them: so it evidently concludes, that emptiness of the Vessels, is not the true cause, of perishing for want of food. Much less can the continuation of Suction, from the exhausted Vessels to the Stomack, be the cause of hunger. For first, such hunger could not be immediately appeased after eating, the Vessels receiving no part thereof, till a considerable time after, when distribution begins to succeed concoction, as is well known and confessed. Secondly, 'twill appear to such as shall duly consider it, that the Vessels or Veins are then fullest, when the Stomack is emptiest (*& è contra*) the emptying of the Stomack, beginning with the filling of the Guts, and Veins. Nor shall we need other arguments, against this Suction (though it were easie to charge it with more difficulties) than that the owners of it, will be forced to prove, there is some such power of moving by attraction, drawing or Suction, which will be a harder matter than it appears at first sight. Though as not making to our present purpose, I shall not determine ought, concerning it. B 4 3. In

3. In confirmation of this our Assertion, viz. That the concoction of the stomach is a kind of fermentation, it will not be amiss to shew the reason of some circumstances of it. And first, concerning that preparation, which meat receives in the mouth, by chewing or jawing of it, which is rather a bruising than mincing: and it is a common observation, that flesh minced very small, is of much harder concoction, than if eaten by bigger pieces; and a sufficient reason is withall assigned, that meat minced, slips down into the stomach, before it be duly masticated or chewed, which is so necessary an antecedent of concoction, that the Arabian Physitians are wont to say, *That he that chaws not his meat well, hates his own Soul.* Now that any thing bruised will soon after corrupt, is evident in all fruits; which will sooner putrifie, after bruising, than if they were cut with a sharp knife into many pieces. Thus a flesh-wound, made without bruising, will commonly heal again with little or no corruption, but not if the part were bruised at the same time. Thus the common practise is to bruise Whitloes, to ripen and break them the sooner. And thus

thus to conclude, our meat by being bruised, becomes of much easier and speedier concoction, which seems to be the reason why Nature has given to most Creatures, namely, Dogs, Wolfes, Swine, Foxes, &c. three sorts of teeth; to wit, Tusks to kill their prey with, sharp fore-teeth or cutters, wherewith they tear it into smaller pieces: And lastly, Grinders to chew and bruise it, the better to prepare it for the stomach.

Birds seem to grinde their meat in their Gizzards, after it is first well soaked in their craps, for which purpose they pick up sharp stones, and their stomachs are made of two large Muscles; one, on either side: the chief instruments in this work of Moliture, or grinding. The Locusta or Lobsters has his teeth placed in his stomach, and so have the rest of that kind, which they imploy for the same purpose.

4. Our next observation shall be upon two Rules of Diet, commonly given by Physitians; the one is, that we should not put new meat into our stomach, till after a perfect digestion of what was eaten the meal before: the reason of which Rule, seems

seems to be this; That it is necessary the stomach, should continue some time empty, that so the Fracid Tincture, or small corrupted remaining portion, of the former meat, may have acquired its due acidity; whereby it may the better help the succeeding fermentation or concoction. And it is no more than if you should advise the House-wife, not to make any new Bread till the Leven be grown ripe, or sower enough to leaven and ferment the Mass of Dough. The second Rule is, that we should leave eating, with some small appetite to eat on; or that we should rise from Table with an appetite: the reason is almost the same with the former, and may well be illustrated by the same instance, which is, that it is requisite, the Leven should bear some just proportion, to the Mass it is to ferment. Thus if we rise with an appetite, it will appear that we have not over-charged this ferment of our stomachs, for appetite being, as is said, a sense of pain caused by the sharpness of this acid ferment; it follows, that this acidity is not yet quite obscured by the late mixture of food, and consequently the stomach, not charged with
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more, than may be well digested, at once by it. And these are Rules, very fit to be observed, as well by those which are of a more robust nature, as of them (especially) who have weak stomachs, and find themselves indisposed after eating.

5. 'Tis further advised by some Physicians, that such as have weak stomachs, should forbear drinking, till they have neer dined: and we commonly observe, that drinking just before dinner, spoils our eating, which it does, by diluting this ferment of the stomach, whereupon the sense of pain, and consequently hunger, abates very much, or quite ceases for a time. And 'tis usually seen, that they who are great Drinkers, are bad Trencher-men: and that as well, for that much drinking relaxes the tone, and extenuates the coats of the stomach, as more especially, for that it washes away by little and little, all this fracid tincture, or sowre ferment, of the membranes thereof, which is as well the cause of concoction, as of appetite or hunger.

6. Bulls Blood drunk, was found a present poyson by the Ancients, and Milk taken plentifully, and after curdling on the stomach,

mack, has often been the cause of great and mortal Surfeits: the reason of both is the same; for that, both blood and milk being curdled, and brought into one hard lump, becomes insuperable to the stomach. Whereas, if the same be suffered to coagulate (before they be eaten) and broken into small parts, they will have no such effect, and instead of poysoning, will afford an indifferent good nourishment to the body: So far seems *Helmont* to have missed the mark, when he says, *The cause of this poyson is, Imago Ira, in Sanguine Taurino.* And I doubt not but a lump of Beef, or a piece of Cheese, of the same bigness, whole in the stomach, would as surely poyson, if not more effectually. And this may farther confirm, what is said in the third paragraph, of preparing our Food, by chewing, &c.

7. The inward membranes, or skins of the Gizzards of most Birds (especially such as feed on corn) prepared, by drying and powdring them, are held a great help to concoction. Now the acidity of them is very manifest, and no doubt they do no otherwise comfort our stomachs, than by encreasing and corroborating that ferment so often

often mentioned. Thus, the dung of several Animals prepared, namely of Wolves, Dogs, Peacocks, &c. have been approved of in divers diseases; or distempers of the stomach and guts, for the same cause. Nay, I have heard that *Paracelsus*, his Occidental Civee prepared, will make an excellent Peptick, for them that can dispense with such homely remedies.

8. It is a famous Question among Physicians, Whether it be better to make a meal of one only dish of meat, or to eat of several meats at the same setting? and it is commonly determined, in favour of the simpler diet. But it seems more consonant to our Opinion, to allow rather of several dishes; for that which is easie of concoction, will help to concoct that which is harder. Thus good Sauces to meats make them set easie, and light, upon the stomach: the Sauces (being easie of concoction) helping the dissolution of the meats. And we may surely expect, a heartier nourishment from them, than single dishes; as we find by experience, better broth to be made of several sorts of flesh, than of any one; and commonly the more variety, the more perfect
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is the pottage. And its well known, we are nourished by juices only, and not by the solid part of our food.

9. Where this ferment of the stomach is more acid than is requisite (as it is in Hypochondriacal persons, and such as are troubled with sowre belches) 'tis found by experience, that to make two, three, or four meals in a day, is better than one: and that fasting encreases much the acidity. That hard meats, as dry bread, Biscuits, and those that are less easie concoction, are more useful than Broths (and other light meats:) which will sometimes (especially taken in a morning, the ferment after long emptiness becoming extraordinary sowre) work so violently, that they will flow up into the mouth, and with their eagerness, set the teeth an edge, and ferment the very ground. But both in this, and the former rule, 'twill be necessary to take some care, that we do not eat much more of our Many dishes, than we should have eat of one, and that the quantity of our meat, at many meals, but equals, or not much exceeds, what we should have eaten at once or twice.

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10. 'Tis observed, that sudden change of diet has sometimes proved very fatal, and been often the occasion of dangerous diseases. The reason may well be, that the stomach, having received its tincture or ferment from food of another nature, is but ill prepared for the concoction of those meats, to which it hath not been accustomed, and from which it has as yet received no stain or impression. Such changes therefore must be made by degrees; and thus I have heard, that horses have been brought to live upon flesh: and some men, have indifferently well supported life, with bread and herbs only.

11. Wolves are said, when pressed with extremity of hunger, sometimes to tear the ground, and fill their panches with meer earth: which surely affords them little or no nourishment. But it serves for the present, to abate the edge of their appetites, till they meet with some prey, at which time, they easily discharge their stomachs of the earth, and fall to better meat. This instance may indifferently well support our Assertion, that hunger is rather a sense of pain from the acid ferment
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of the stomach, than of emptiness from the Suction of the veins.

12. As concoction succeeds best with rest, so motion is said to help distribution. Now by distribution, we are to understand the dispersing, of the thinner parts of the Chyle into the milky veins, from thence into the Subclavials, thence into the right Ventricle of the heart, where the Chyle already is pretty well stained, or imperfectly mingled with blood: from whence it takes its course to the lungs, where by the reciprocations of that part, it is yet more perfectly, mixed with the blood. From the lungs, it descends into the hearts left Ventricle: from whence, it is thrown into the Arteries: where by degrees it receives the form and name of blood: and by them is conveyed into all parts of the body. In regard the milky veins, have no attractive power, whereby the Chyle might be sucked into them (as far as could yet be fairly made appear) nor has the Chyle (much less) any such inclination or power of moving it self that way; it remains, that this distribution of the Chyle, is performed by the motion of the body. And thus we find moderate exercise,

exercise, soon causes an emptiness in the first ways, and begets an appetite. And yet we may likewise observe, that while we sit still, or sleep, this distribution is performed, though not so speedily. Now while we rest, there is no other motion observable, beside that of breathing, which seems to be the true cause of this distribution of the Chyle, till it comes into the Subclavials: for when we draw in our breaths, the Diaphragme or Midriff compresseth the stomach, and gently forceth the Chyle thence into the guts. And again, when we breath out, the Muscles of the belly straight subside, and strongly compress the guts; whereupon the thinner part of the Chyle insinuates it self into the mouths of the milky veins, and by the succeeding parts of the Chyle, is protruded into the Subclavials, where afterward it is moved with the motion of the blood. I do not deny the Peristaltick motion of the Intestines, (whereby the guts distended with Chyle beyond their due tone, do again by their transverse fibres contract themselves) for this is also a partial cause of distribution (as appears in the dissection of live Animals,

mals, where this motion of the Chyle continues after the Abdomen or belly is laid open from one end to the other) but is much strengthened, no doubt, by the Muscles of the belly; besides this Peristaltick motion of the guts, shews indeed in part how they are emptied, but not how they are fitted with Chyle, which is the first part of distribution.

13. Tis worthy observation, that Butter melted, and very well beaten (or drawn) the while, becomes a much pleasanter cause, and easier of digestion, than if it be not beaten; and yet all the difference is, that by beating a great quantity of Air, is every where mingled with it, whereby it very much helps the fermentation or concoction of our meat in our stomachs, after the same manner as is already said of whites of Eggs, in the former Chapter; and indeed all causes are a kind of additional ferments. That there is great quantity of air in Butter thus beaten, may not only be gathered from hence, that after beating, it takes up more room than it did before, or otherwise would do, if not beaten; but the same particles of air are even manifest to sense

sense it self, and the whole Mass of Butter appears, beaten up, into a froth, so far is it from being made thicker thereby, (as we commonly express our Opinions of it) that indeed it becomes much thinner and lighter, if compared quantity with quantity, as is manifest.

CHAP. III.

Of Respiration.

N. I. **T**HAT Animals breath not at all, while in the womb, is most probable, that all viperous creatures, after the birth, cannot live long without breath, is most certain; yet I do not find the uses of Respiration so clearly determined, but that it may afford us matter for farther enquiry. The common received Opinion is, that Respiration serves chiefly for cooling the heart, next that, it yields matter for production of new vital spirits; and lastly, that it discharges the lungs of a fuliginous excrement,

excrement, which seems to transude from the Mass of blood into the branches of the rough Artery: that the heart is cooled by breathing, is very probable, but not immediately; for the air going no farther than the lungs, first cools them, next the blood in them, and consequently the heart becomes less hot, than otherwise it would be; but this is, in effect, no more than is obtained by bathing the limbs in cold water, which does a together (if n t m re effectually) cool the Mass of blood, as much as the air in breathing can be conceived to do it, and yet bathing will in no wise become a Substitute to breathing. Nor does the generation of vital spirits seem to be the chief use of the air in breathing, in regard it is not easie to conceive any such contrivance in the lungs, that may serve for the letting in of air, into the veins and arteries, which contain the blood, without endangering; contrariwise, the effusion of that precious juice, much less has Anatomy, as yet, discovered any such passages unto us. Lastly, as I shall not deny, but that the lungs do discharge themselves of a fuliginous excrement by breathing; so I think

think it as true, that this is none of the principal uses of Respiration. Nor is it at all likely, that either the heart should grow so hot, or that the vital spirits should vanish so fast, or the fuliginous excrement be accumulated in that quantity, upon the intermission of breathing for a short time only, as to endanger our lives beyond recovery, as the absolute necessity of Respiration would seem to enforce. Before I come to deliver my own Opinion, I shall make a slight digression concerning the circulation of the blood, which will not a little illustrate what we are about to say concerning this Subject.

'Tis manifest in the circulation of the blood in Animals, that the blood is moved from the left Ventricle of the heart, through the great Artery, into all its branches, from whence it is brought back by the smaller veins, which discharge themselves into the Vena Cava, from whence it is returned into the right Ventricle of the heart, from whence it is sent by the Vena Arteriosa into the lungs, and so brought back again into the left Ventricle of the heart by the Arteria Venosa. And in this

circular motion of the blood, life chiefly consisteth : and if the same by any chance should cease or intermit, though but for a very small time (less than a minute) death would unavoidably follow. In this motion of the blood, it is observable first, that as the pulsation of the heart sendeth it through the Arteries, into the whole habit of the body, so the return of it by the veins, seems to depend chiefly upon the tonical motion of the body ; for the parts being extended by the flowing in of the blood, somewhat beyond their tone, do again gently subside, and thereby continue the intended course of the blood toward the heart again. An argument hereof is, that all Paralytick parts grow immediately cold, and that for no other reason, than that the tonical motion, together with the power Locomotive, ceasing, the circulation is either very weakly, or not at all performed through that part, which then grows cold, for want of that constant fresh supply of blood, which formerly kept it warm. But herein the tonical motion is not a little helped by exercise and labour, which we find, by experience, to cause the heart to beat

beat quicker and oftner, as also to induce a necessity of breathing more frequently; and this it doth no otherwise, than by accelerating this circular motion of the blood, which then enforceth the heart and lungs to double duty. Our second observable in this circular motion of the blood is, that there passes as much blood from the right Ventricle of the heart into the u gs, at every pulse (taking one time with another) as is sent from the left Ventricle into all the parts of the body beside. Nor can it be otherwise, the left Ventricle being supplied from the lungs only; and the lungs receiving it, not elsewhere than from the right Ventricle of the heart. So, that to continue this circular motion of the blood, 'tis necessary, the supply neither exceed, nor come short of that quantity, dispensed from the left Ventricle of the heart, into the whole body (the Lungs excepted.) From hence it follows, that there flows a greater quantity of blood, by many degrees, into the lungs, than what is sufficient for its own private use. As also, that the blood in the lungs, must of necessity, move very much faster, than it does in any part of the

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body : though we take for example, the great vein or artery themselves : and that, in the same proportion, as the *Vena Arteriosa*, and *Arteria Venosa*, are smaller than the trunks of the foresaid great vessels. For, let the same quantity of liquor be conveyed through a pipe, whose capacity is but one fourth, or one tenth, so big as another pipe, through which the like quantity must pass in the same time : and it is evident, the liquor must run four times, or ten times as fast, through the smaller pipe, as it does through the greater. And thus, it appears, that a very considerable part of the Mass of blood, is continually running through the Parenchyma of the lungs ; and that, at a much swifter rate, than it doth, through any part of the whole body beside.

3. Farther, before we proceed to treat of the use of Respiration, it will not be amiss to consider, what kind of motion that is which the lungs are exercised with, in breathing. Nor is it any other, than a motion of dilatation and constriction ; whereby the lungs are reciprocally opened and shut, somewhat after the manner, of a pair of

of Organ-Bellows : the air entering into them, when dilated or opened, and receding again, upon their subsiding. And this is what we call Respiration. Nor yet, does this reciprocation of the lungs, proceed from any power to move, they are endowed with of themselves. For, if we consider, the frame and structure of them, they will appear of a Parenchymous kind of substance, not much unlike the liver, and altogether void of Muscles; without which, no local motion can be performed. We may conclude therefore, that the lungs are moved by consent, and that chiefly of the Diaphragme or Midriff, in a free and ordinary breathing. But, in any difficulty of breathing, as in the Asthma, Tabes, violent exercise, &c. not only the Midriff, but almost all the Muscles of the trunk of the body, name'y, those of the Belly, Chest and Shou'lders, seem to afford their assistance, in this great work of Respiration. The motion of the Midriff is first downwards; whereupon the lungs follow, and the air is admitted, and again upwards; whereby the lungs are compressed, and the air excluded. Thus you see, that as the construction

struction of the Midriff, so is its motion, somewhat different from that of other Muscles: which, as being well known, we shall not need to spend longer time about, but come to the publick use of the lungs, in the Oeconomy of our bodies.

4. In the circulation of the blood, we ascribed the reduction of it again into the right ventricle of the heart, to the Tonical motion of the body: where yet, as we have said, the blood moves but very slowly, if compared, with that swift, and rapid motion, it is carried on with, through the lungs; where it moves, perhaps, ten times as fast, as in any other part of the body; as has been already proved. Which notwithstanding, we shall not be able, upon perusal of the structure of the lungs, to conclude, that they are endowed with any considerable tonical motion, as may be gathered, as well from their want of Muscles, as for that their substance, is very spongy and flaccid: and their common integument is but one thin membrane. Nor was it without a particular, and that a most excellent design: that Nature thus contrived the lungs with little or no tonical motion in them. For first, had this Tone been equivalent to the

Mass of blood, to be returned by it; it would much have retarded the influx of the blood, into the lungs: and consequently, have hindered a great work of Nature upon it there; as shall be shewed hereafter. But chiefly, for that it has largely supplied such defect, by the assistance of the Diaphragme, which becomes the cause, both of dilating, and contracting the lungs; according to the occasion, and at the will and pleasure of the Animal. And this is, indeed, the first and principal Office of the lungs; as to what concerns their reciprocal motion: Namely, that upon the subsiding of them, in Respiration, the blood may be vigorously squeezed out of them, through the *Arteria Venosa*, into the hearts left Ventricle. And because, the substance of the lungs is very tender; Nature contrives, that not the Diaphragme immediately, but the air inclosed in the cavity of the brest (for this very purpose only) being first, streightened and crowded, as it were, together, by the motion of the Diaphragm upward, should cause this compression upon the lungs; while by its Elastic power, it endeavours to dilate it self again, to
its

its usual dimensions. Nor could any way of compressing the lungs, (thereby to discharge them of the superfluous blood) have been contrived more equal: for this pent air, is as apt to press upon one part, as on another. Nor yet more gentle, and secure: for what contact could have been more delicate, or less apt, to wound the tender membrane of the lungs, than the air inclosed in the brest about them? Nor need any doubt, but that the air, thus compressed and streightned, is of strength sufficient for this service: and that there is such a Spring in the air; who, shall but consider with what force, the air breaks forth of the Wind-gun, and other Pneumatic Engines. A farther confirmation hereof, may be had from hence: that such wounds, as perforate the brest, if left open, but for a little time, do quickly cause a difficulty of breathing: and I do not much question, but if both sides of the brest were perforated, it would as certainly dispatch a man, as hanging; and that, almost, in as short a time. Farther, in the dissection of live Animals, Respiration continues, long after the Abdomen or belly is laid open; but immediately

immediately ceases, upon dividing the Diaphragm or Midriff.

5. Whether the air, that enters into the lungs, by the Wind-pipe, have a share in this compression of them, for the discharging of the blood, or not, I am as yet not well satisfied. At first view, this compression should seem, to be best made upon drawing in our breath; between the air implanted in the cavity of the breast, and the air, in the rough Arteries: (or branches of the Wind-pipe) but at such time, the implanted air, is but little or not at all contracted: and therefore we must conclude, that either the air taken in, bears no part in this compression: or which is most probable, that the sanguine Vessels of the lungs, are not only strongly compressed, upon expirations; but also upon inspiration; that is, so often, as the lungs are removed from their natural, middle, or indifferent situation: whether expanded or contracted. Viz. *Tam in quiete externâ, quam internâ.* We must likewise allow the air to cool the lungs very considerably, and that it discharges them of a fuliginous, or rather vaporous excrement. But these are,

as we have said, the less principal uses of Respiration. As for the airs becoming the matter of Vital Spirits in Respiration, I shall say no more, than that I neither find any need of it, nor any may for the mingling of it, with the Mass of blood.

6. Allowing what has been said, concerning the use of respiration: we may, perhaps, find out a more commodious reason of sighing, than has been yet assigned. For, if a man shall for a while, either wholly forbear breathing: or, at least, breath seldomer, and lower, than is his usual custom: the lungs, in the mean time, swell and fill themselves with blood, (for want, of that frequent and strenuous compression, formerly equal to the influx of the blood,) while the pulse is not so full as ordinarily: the hearts left Ventricle not receiving its due supply from the lungs, which in this case receive more than they deliver: Hereupon a man is necessitated, (for avoiding suffocation) to fetch a great breath, or sigh, which may more strongly, than usually, compress the substance of the lungs, and reduce them to their former estate. And thus, great attention, any deep contemplation,

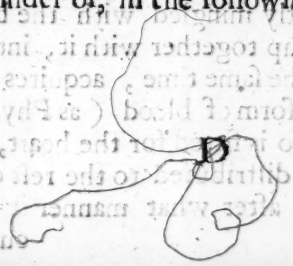
templation, sad thoughts, and a melancholick constitution; do often become the cause of frequent sighing: As also, a natural sloth, or less aptness in the lungs themselves, or Diaphragme; to motion; will sometimes make this passion customary, and habitual. And it is observable, that the pulse rises very much upon sighing; for the first stroak, or two, at least: the blood coming to the Artery again, in that abundance, that a man may feel the tingling of it, at his very fingers ends.

7. Furthermore, it may not a little strengthen our Assertion, that in all great difficulties of breathing: and where there is most imminent danger of suffocation, to let blood in good quantity, is commonly prescribed, as the last remedy: and which seldome fails, of giving, at least, a present relief, let the cause be what it may be. And this it seems to do, by diverting the course of blood from the lungs; while they gently again discharge themselves of their burden. And in case of hanging, or strangling, letting of blood in great quantity, has sometimes saved mens lives that have been executed; and this by no other ways, that

I can think of, than by helping to discharge the lungs of their oppression, as has been already said.

8. And thus we have, if our Opinion fail us not, discovered the true use of Respiration. We have, also of consequence, freed the heart, of almost one half of the task imposed on it, by the modern Physicians. For since the circulation of the blood consists of two parts, *viz.* First, the conveying it from the heart, or center, to the rest of the body, as to a kind of natural circumference. And secondly, the returning, or bringing back of the blood again, to the heart. The first part, we conceive to be the Office of the heart. The second part, seems to be the work of every particular member, to discharge it self of its own superfluities: For which purpose, nature hath endued them with a tone, or tonical motion, sufficient for that service, the lungs only excepted, wherein Nature hath worthily imployed her industry, by the additional contrivance of Respiration, through the assistance of the Diaphragme: which labour of the lungs, in Respiration, for the returning of the blood to the left Ventricle

Ventricle of the heart; seems to equal that of the tone, or tonical motion, of all the other parts of the body; for the lungs convey the same quantity, with all the rest: that is to say, the whole Mass of blood, through them; and that in as little time, as the same passes through the rest of the body. And, if it carries it not so far, it moves it so much the faster. And so, we shall have entituled the lungs, to one full quarter part, of this work of the circulation of the blood, leaving an other quarter to the tonical motion of the body: And the first, and worthier half, of dispensing blood and life through the whole body, to the heart, as its proper office and duty. What part, the lungs may justly claim to themselves, in the business of Sanguification, we shall more conveniently find place to consider of, in the following Chapter.



CHAP.

CHAP. IV.

Of Sanguification.

N. I. **T**He Chyle, when separated from the remaining unprofitable parts of our Aliment is, by proper vessels of its own (the discovery of modern Anatomists) conveyed directly into the Subclavial veins, and from thence into the right Ventricle of the heart, where it is mingled with a larger quantity of blood, returning home by the great vein, together with which it is immediately transmitted to the lungs, where (though it make great hast through, and moves very impetuously, as has been said, yet) by reason of the length of the way, it continues a considerable time, and is more perfectly mingled with the blood, and wrought up together with it, into one Mass, and at the same time, acquires both the name and form of blood (as Physitians term it) and so is fitted for the heart, from thence to be distributed to the rest of the body: where after what manner it is circulated,

culated, we say not, as a thing already sufficiently known, and whereof we have delivered our sense already.

2. That Chyle is very easily mixt with blood, is evident, for that it is the matter whereof all blood is made, by a farther continuation, of that fermentation or concoction, begun on it in the stomach. Nor yet is the proportion so great between them, but that upon mingling; the dissimilitude of parts, becomes immediately the cause of an extraordinary ebullition: which is very much encreased by the reciprocal motion of the lungs, whereby the blood is wrought almost all into a froth or foam, by that time it gets into the left Ventricle of the heart. Which sudden excess of heat, is not unlike what happens upon the mingling several Chymical liquors together, as Spirit of Wine, and Spirit of Turpentine, and other such like, where the heat becomes so great, that it often endangers the vessel they are contained in. And this is the cause of that heat a while after meals discernable in Hectical persons, and others, otherwise affected: and which in many appears, by flushings in the face. Now that

the blood is wrought up to that froth, we speak of, during its passage through the lungs; is not only suitable to reason, but appears most evidently, in those sanguine excretions from the lungs, which happen in consumptive persons: nor does that frothiness, then observable, proceed from the mingling with it the air we breath, for that at one breathing out (or expiration) could not be sufficiently performed.

3. The blood, by several very learned men; has not unaptly been compared to wine; and in my Opinion, the Chyle may as properly be likened to the juice, newly pressed out of the Grapes: which if it were by certain intervals, in a due proportion, poured gently into new wine, or must, as it begins to cool, would again renew its ebullition, and continue the warmth of it, to what degree is requisite, and that so long as this practise shall be continued. And from this Illustration, may be clearly gather'd, the necessity and use of eating, at least within certain periods, or intervals: to wit, that by the frequent affusion of Chyle, the blood may again recover its motion, warmth and vigour, without which
the supply,

supply, it would soon languish, cool and congeal, and consequently, death ensue. Now that the lungs are indeed the principal *Officina Sanguinis*, may be farther collected from Consumptions of the lungs, wherein all parts of the body are so suddenly extenuated, by the affection of the part.

4. 'Tis probable, that the blood during its stay in the lungs, does not actually dilate it self, and rise into froth, but only acquires an aptness so to do, as soon as it is at a little more liberty, as appears in blood spit out of them; and consequently, when it falls into the left Ventricle of the heart, it immediately dilates it self with great force, in the manner of bottled Beer; and in this manner does, for ought I know, in great part, become the cause of the Diastole, or expansion of the heart, which being extended, beyond its due and natural situation, does again violently contract it self, by a power almost all bodies have of restoring themselves, and which we call the tone, or tonical motion. And as we observe in a Switch bowed down, or in a Pendulum removed out of its place, that they return beyond the perpendicular; so it

fares in this motion of the heart; whereby it is again more contracted, than is natural to it, and so of it self returns again to expand it self, and is again violently distended, as before, by the influx of more spumy blood from the lungs. Now though it may be objected, that the pulse in the heart continues, many times, a long while, after it is taken out of the body; and when there is no longer any such influx to be pretended, as the cause of it. To this I answer, that such pulse, is what the Physitians call the *Myurus*, or Mouse-tail, for that its *Dia-dromes*, or differeuces, between greatest and least expansion, do continually become less and less, even as it happens in *Pendulums*, once removed from the perpendicular, which continue their motion for a long time, after the hand is from them that first set them awork. At least this ebullition of the blood in the heart, seems not a little to contribute to the continuation and strengthening of this pulsive motion. In contemplation of this *Orgasmus*, or fury, as I may call it, in the blood issuing out of the lungs, and now to be distributed into all parts of the body Nature contrived

trived the Arteries with thick and double coats, the better to contain it : whereas the veins designed for the carrying it back again to the heart, at what time the blood is very much cooled and tamed, are only made of single membranes, as being sufficient now to hold it. And this is all the difference between Arterial and Venal blood.

5. It seems of all other Opinions the most probable, that the blood, when arrived at the extremities of the smallest Arteries, is there shed upon the habit of the body, in the belly, or fleshy part of every Muscle; each Muscle having the proportion, or likeness, of one of the quarters, or Acetabula in an Orange, or a Lemon; upon the compression of which, either by local or tonical motion, it is not hard to conceive, how the blood is again forced into the mouths of the veins; and after the same manner has every Muscle its particular membrane. And thus we find that blood issues forth, upon pricking the flesh, in any place; although it cannot be imagined, we should always prick a vein or Artery: or we must conclude, there is nothing

else in flesh, but a multitude of capillar veins and arteries, which were absurd to be asserted.

6. To make short: Life it self is but a continuation of this vigorous fermentation of the blood, which is so long maintained, as the Mass of blood is kept hot, and circulating through the veins and arteries; and if done by those means, and in that manner, which is suitable to Nature, so long the body is in perfect health. If it be too violently fermented, or moved, it does, in general, become the cause of Fevers, and other acute diseases: as contrariwise, if the fermentation be too weak, from thence all chronical diseases take their original: and that particularly, according to the several irregularities that may happen, either in excess, or defect, in this fermentation and circular motion of the blood. We descend not now to particulars, the most we aim at in this Treatise, being but a general method, either of preventing or curing diseases, after a way not yet treated of.

Since the discovery of the circulation of the blood, it has been the Opinion of many great Assertors of it, that where the
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indication is of letting blood, it matters not out of what vein it be taken, provided, so many ounces be let out, as the disease requires. And this their Assertion is made probable, by many arguments alledged by them for that purpose; and but for the tonical motion of the habit of our bodies, would be as great a truth, as any is in Physick. But the tonical motion of the parts once admitted, We must likewise grant, that those parts will empty themselves first, that lie nearest to the incision; as well, for that there is less strength required to force any liquor to a shorter than a longer distance: as also, because the more remote parts, or Muscles, do exercise a kind of Antipraxis, or Contranitency, and so become of mutual impediment one to the other: whereas the nearer parts, do almost immediately discharge themselves upon the Orifice, or incision.

8. From this tonical motion of the whole body, it happens, that any particular part is sometimes preternaturally swelled, either from a stroak, the application of cupping-glasses, or generally any other cause, which may weaken the tone of the part; for in
such

such case, the heart continuing its motion, for the distribution of the Mass of humors, it is very easie to conceive, that more of them will pass into that part, where least resistance is made, than otherwise would have happened, had the part continued in its natural tone and vigour.

9. From hence likewise the reason is to be sought, how it happens in letting blood, that so large a quantity should in so small a time, issue out at the incision made in one vein, and that perhaps none of the largest. For if we duly consider, how quickly a man may bleed to death, by the opening (for instance) of a vein in his arm; we must conclude, that the blood passes not much faster through the heart, than it does at the same time out at the Orifice in his arm; and that consequently, there is but little blood received, during this evacuation, into the rest of the body, which doth then by its tone discharge it self (into the great vein) of its Plethora, or superfluous blood, which returning again from the heart, toward the habit, the greatest part takes its way to the part, where the incision was made, it finding there

there no other opposition, than what it has while it is travasated from the arteries into the veins, through the smallness of their mouths, which yet is in part recompenced by the multitude of them. Now if it be agreed on, that in half an hour a man may bleed to death, or thereabout, if a vein in the arm be kept open: and that there will, in such case, be about one half of his blood let out, computing what is likewise contained in the capillar vessels, and what remains in the habit of the body, it will follow, either that the whole Mass is compleatly circulated twenty four times in twenty four hours, or a natural day. Which seems a little too often, or that the blood circulates much faster, while a vein is breathing, than at other times, which is not improbable; or that a man may continue bleeding longer than half an hour, which is not so likely: or that there is not in such case of bleeding to death, one full half of the Mass let out: All which may deserve a more exact scrutiny, but must now be left to be decided by the experiments of such, as are conversant in the dissection of live Animals.

10. It is frequently seen in horses, that upon long and much labour, they lose the sight of their eyes; nay, I have known some horses that have lost one or both eyes, with one days over-straining, either by draught, or course, and so became blind of a sudden. And then we commonly say, they have drawn their eyes out: But how the eyes should suffer, or what part they take in the labour, or violent exercise of the body, is not so easily made out, unless by this tonical motion of the body, which now becomes much strengthened by the violent local motion, either in drawing, or running, whereby the Muscles of the whole body are much more compressed, than in their natural state of rest, and consequently, do not only not admit of the usual quantity of blood and humours, due to them by circulation; but by their violent and frequent contraction, do return them back in much a larger proportion, than they now receive them; whereupon the lungs become over-charged, which causes frequent breathing, and makes the pulse quicker and stronger than formerly, distends the great vein and artery, with a greater

greater quantity of blood, than is usual: Whereupon the Artery, by its pulse, and tone endeavours to discharge it self upon the habit of the body, which not receiving it in its due and accustomed proportion, the blood does in a more than a usual manner, fill the vessels of the eyes (and other weak parts) and either by distention, compression, or extravasation of blood, or other humor, the order and disposition of the parts of the eyes becomes so confused and disturbed, that no wonder if blindness immediately, or soon after, do ensue. Now 'tis manifest from hence, that where the body of an horse is clean, that is to say, not so full of humors; and where blood abounds not over-much, this accident shall not easily happen. And here we are to observe, that though the native tone of the eye do rather exceed that of the other parts, than come short of it, yet it is not sufficient to resist this influx, when the tone of the other parts is so much strengthened by the violent local motions of the body.

II. If we a little reflect upon the manner of the **Circulation** of the Blood, and how

how by very modern discovery, the Chyle is first mingled with the blood, in the axillary or subclavial veins, from whence it passes by the right Ventricle of the heart, through the lungs, into the left Ventricle; from thence to be distributed into the whole body: One thing very remarkable will arise to our observation; namely, that what part of the blood is sent toward the head by the carotides or arteries of the neck, flows thither very crude, and accompanied with all its excrements, it having not yet received or suffered any depuration, or alteration, from the Reins or Spleen, like that which passes into almost all other, especially the lower parts of the body (though indeed it seems not to be cleansed of the gall, till it returns home again through the liver.) Now though Nature's purpose herein be very obscure, that the blood thus impure, should be designed for the service of the most Noble part, yet, that so it is, will farther appear, by the several Emunctories (or sinks) wherewith the head is in a particular manner provided, as the ears, eyes, nose, palat; every of which, discharge the brain of a several excrement, and

and that no longer useful to the body, except what is secerned by the palat, which is for the most part again returned to the stomach: for the better separating of which, Nature has industriously placed about the head, so many of those serous vessels, called the *Ductus Salivares*, which seem here to perform the same Office, to that part of the blood sent to the head, which the Reins do execute, to the remaining Mass. Hence no wonder it is; if excessive drinking do so much weaken the brain, cause Catarrhs (which is nothing but an over-flowing of the *Ductus Salivares*) weaken all the faculties of the Soul and senses, and at length, enervate the whole body, although, at the same time, the Reins do their duty indifferently well; and this especially, if the native tone of the brain be weak, it being then so much the less able to discharge it self of such superfluous excrements. This may be said in general, that the blood is thus sent to the brain, before depuration, in regard of its publick Office, that the same may there be farther elaborated, as shall best suit with its service in that Noble part. Thus much,

much, by way of an useful digression, may suffice, concerning tonical motion, and some considerable circumstances of it; which as well for the assistance it gives the heart, in the circulation of the blood, as for the many useful indications from thence arising, in the Doctrine of Phlebotomy, was most properly to be handled in this Chapter of Sanguification.

12. And now I do not much doubt, but whoever shall have carefully perused what has been lately said concerning Sanguification, and the use of the lungs; will as readily conclude with me, that the lungs do bear a very principal part in the work of Sanguification, for in them the Chyle is perfectly mingled with the blood; in them one half part of the circulation is performed; and in them the blood seems to free itself, first of all, from any excrement: to wit, a fuliginous, or rather a vaporous watry superfluity (which passeth out together with our breath.) And this seems the first and chiefest part of Sanguification. The second, is a farther elaborating the Mass of blood in the arteries, which is performed by the pulsive motion of the heart. The third

third and last part, is the depuration of the blood, whereby its superfluous excrements are separated from it : and this is performed by the rest of the bowels thus : by passing through the Reins, it is drained of its serous parts : Another excrement it seems to leave behind it in the Spleen, though of what kind, is not yet well determined among the modern Physitians : But on all sides it is concluded, that while it passe through the liver, as through a Streiner, it is there purged of choler, which in most Animals is collected in a little bladder, or Cistis; from whence it is transmitted to the Intestines, where it becomes a kind of natural Clyster, and provokes to the excerning the excrements of the first ways, as they use to term them. And this is what lay in our way, to say at present, concerning Sanguification.

CHAP. V.

That often changing the Air, is a friend to health: Also a discovery of a new method of doing it, without removing from one place to another, by means of a Domicil, or Air-Chamber, fitted to that purpose.

N. I. **H**AVING hitherto shewed what part the air acts in all fermentations, and that in respect of its tone and temper: *Viz.* its difference of rarity, and density, and of heat and cold; and that in general only: not considering what other dispositions of the Air may make it apt to promote or retard the motion of fermentation; whereby it may also powerfully operate, to the continuation or destruction of mixt bodies: as not so directly serving for the illustration of the Subject, we principally intend in this discourse. Having farther made it probable, that the work of our stomachs, upon our Aliments, as also,
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that Sanguification it self, is a kind of fermentation. And lastly, having asserted the publick Office of the lungs, together with the use of breathing, as well in promoting the circulation, as elaborating of the blood. And having likewise said something of the tonical motion of the body; and all this, after a manner, somewhat different from what has been hitherto received, and taught in the Schools. It remains, that from these Physiological Speculations, we proceed to raise some medicinal conclusions and contrivances, very useful for the cure, as well as prevention of sundry diseases.

2. But first it will be necessary, to premise, that the Atmosphere, wherein we breath and live, is heavy or ponderous, and presses more or less, upon all bodies in it; and upon all sides exposed to it; and that especially, according to its difference of rarity and density. So that upon the tops of very high hills, and in bright weather, the Atmosphere will lie lighter upon us; and all other bodies than the same, will in thick weather, and in deep valleys; and consequently, that we move with more difficulty when the air is thick, and with more ease

when the same is thinner ; which is as much as to say, that the resistance of the Medium is proportionable to its measure of rarity and density. All which we now take for granted , and shall spare our selves the pains of proving , as what has been already sufficiently made out by several learned men in this our Age ; from whose writings such as doubt, may receive very ample satisfaction. And we shall only conclude , that if all motion, be easiest performed in the thinnest air, then in such an air, we shall breathe freer, digest our meat better , and be less tired with waking, or working , than in a thicker air ; and consequently, perform all the functions of life better , as is indeed manifest, even to experience it self. (which yet is wont, for the most part , to take notice but of the more gross observables) for who almost is there, of so happy a constitution , that during health it self, and in the prime of his years , is not in some measure affected by the alteration of the weather, and by the change of the air ? for, as for such as are sick , the very moments of life and death , do seem to depend upon this change : and such as are Valetudinary persons,

sons, commonly find, to their great grief, that their own bodies, may indifferently well supply the want of a weather-glass, in admonishing them, not only of the changes of the weather, but of the seasons of the year also. So very considerable is this alteration of the air to all mixed bodies, especially Animals, and among them, to men more particularly, as being less armed against the injuries of the air, and among men most of all, to such as are infirm; as hath been said.

3. Now if the Natural and Vital Functions are better and easier performed in a purer air, than in a courser; no wonder, if upon changing the worse for the better air, many (especially Chronical) diseases, do by degrees from thence, receive a cure: which were before invincible, by other remedies: or must have been patiently endured, till the alteration of the season of the year, introduce that change in the air, (as to its tone and temper) which is sufficient so to rectifie the motion of the humours in our bodies, as at length to overcome the distemper. Which might possibly have sooner been obtained, by a seasonable removal into a whole-

some, warmer, or drier Region. But it is much more remarkable, that not only the changing a bad air for a better, is available in such cases; but much more the often changing of the air, though sometime for a worse, which is not only confirmed by experience, but likewise by the Authority of *C. Celsus*, who strictly enjoins it, and adds this as a reason, that if a man reside in so good an air, that he knows not where to remove to a better, yet it will be profitable for him to remove, and that often; for in case of sickness, that may justly be esteemed the worst air, as to the concernment of the Patient, in which the disease took its beginning. The reason (in gross) why changing the air at all, should cure diseases, may be this; that the body of man is capable of enduring a greater latitude, either in the tone or temper of the air, than what the disease thus curable can consist with; and perhaps no other Animal is able to endure that variety of Climes, that a man may indifferently enjoy himself in. And thus men are found to inhabit in all parts almost of the Inhabitable World, whereas other Animals are proper to this or that particular

particular Region, and will either die, if transported into other places, or at least lose much of their vigour, and not generate. The same is also observable in plants. 'Tis said, that Lice bred on this side the Line, (or Aequator) will immediately all die on the other side the Line: So that it follows, the Ptherasis, or Lowlie disease, will be speedily cured by such a change of the air or Clime: and all, or most other diseases, do seem to bear some Analogy in their existence, to the life of that despicable little Animal. But that the often changing the air, is so much a Nobler Remedy, than that of removing once for all into the best air: The reason is surely this, that first, in the finer air, the motion of Fermentation of the humors, and juices of our bodies, is better performed, and somewhat accelerated; and again, a little retarded, by a speedy remove into a grosser air, whereby the humors are, as it were, kneaded or carded; and the disease at every such change, receives a notable shake, which seems to be much more sensible (if I may so say) of every such impression, than our bodies are. And this often changing the air,

does well resemble the many stroaks, which are necessary to fall the sturdier Oak, while one or two, though very considerable ones, are not sufficient to bring him to the ground. I should therefore from hence conclude, that if once changing the air, do not in some reasonable time give assurance of a cure, that then we doubt not, with the Judicious *Celsus*, to change, as often as shall seem convenient, which surely will, (other helps not neglected) at length (provided the disease be curable) put an end to, and wholly eradicate the distemper, be it almost what it may be.

4. But it will not be amiss, to be a little more particular, in shewing, after what manner the air works upon our bodies, and affects it with its several alterations, and differences of rarity or density. And first, I think it will be granted by most men, and might be clearly proved by several experiments, that there is a certain quantity of air in all liquors, insensibly dispersed in very minute parts, through the whole Mass of them, which small particles do actually symbolize with the Medium; and will, by contracting or dilating themselves, cause
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the liquor wherein they reside, to take up sometimes more, and sometimes less room: as will be manifest to him, that shall fill a large glass bottle, of about a pottle or more, with water, till it rise two or three inches in the neck, which will need to be very slender, and somewhat long, and it will soon appear, that the water shall sometimes rise, and at other times fall, almost after the manner of ordinary Weather-glasses: as will be much more manifest, if it be for a while set neer the fire, so as to be a little warmed by it. Now the humors and juices of our bodies, have likewise their certain proportion of air in them, and that in a far greater measure, than common water, which seems of all other liquors to contain the least (as is probable from the small inclination it has to be fermented) and therefore it seems to follow, that upon all changes in the Air, or Medium, the juices of our bodies are affected: (even after the same manner, as has been said of common water) and that according to the alterations of the Weather, of day and night, and of the seasons of the year. Which alterations, or changes, in any one particular place,

place, have a kind of orderly method of succeeding one another, but much different from that of another place or Region, which, though it have the like alterations of Weather, Seasons, &c. yet the order or method of this variety, is as it were, of another Scale from that of the former. And the differences of heat and cold, density and rarity in the Medium, are either greater or smaller, than those of the former: whereby the body removed from the place of its former abode, to another, is affected with the varieties aforesaid, after another manner than what was usual to it. Whereby the face (if I may so say) or complexion of the humors and juices in the body, will be much altered and changed from what it lately was: and consequently, the Morbose Character very much defaced, if not wholly obliterated. Which effect will in all probability more certainly succeed upon often, than upon once changing the air, as has been already sufficiently evinced, both from reason and experience.

5. Of all changes of the air, that is commonly observed to be most effectual, for
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the cure of any distemper gotten abroad; which is made by removal from a forreign Country, to a mans own Native Soil, or the place of his birth, and first abode: which seems to be true (*cæteris paribus*) from hence, that the Aerious Particles, which originally go, as one principal ingredient to the making up of the body, were at first of the same tone exactly with that of the Medium: and it cannot be imagined, but that upon any considerable removal, these Aery Particles must be more or less dilated, or contracted, than they formerly were, whereby the body will be preternaturally affected. Which though during the state of health, it be not cause sufficient, perhaps, to manifestly hinder any action of the body; yet in case of a disease, it seems to be a notable relief to Nature, to be restored again to its Native constitution (as far as is possible) which is a kind of renewing, and no small refreshment to the body: from whence a Patient seldom fails of a relief, and very often finds a perfect cure, in several contumacious diseases.

6. I would not be so far misunderstood:

stood : as if I asserted the alterations our bodies suffer from the Medium , to be exactly the same, in degree, with those of the Weather-glass; for that I think were hardly consistent with perfect health, as we find these alterations in most persons are : though in infirm bodies they are very manifest. But I suppose, by this time , it may be expected from me , that I give an account of this difference , and say how it comes to pass , that the air in our bodies is not affected by the Medium exactly , after the manner of the Weather-glass , but in a less degree , where for the only reason I can think of , I shall assign the tone or tonical motion of every body so often mentioned ; which being compressive of all the parts of our bodies , it very considerably checks and hinders that dilation of the humors, by means of the rarified air , which would otherwise ensue upon the like affection of the Medium : which compression, or resistance of the tone , or tonical motion of the body , may be very well illustrated from a bottle full of (nothing but) air, well stopt , and afterward exposed to the differences of heat and cold. In which case, it cannot

cannot be imagined, that the included air, is at all either dilated, or contracted: not the first, because there is no room for it to expand it self upon, nor yet the last, because the sides of the Bottle are not apt to subside, without which, no sufficient reason can be given, why the air, upon external cold, should quit any part of the place it formerly replenished. And yet in some cases, the differences of heat and cold may be so great, as to prevail over the strength of an ordinary bottle, and break it, as has been often found by experience. But here we must observe, that though the sides of the bottle give no way at all to the air included, yet the tonical power of the body doth somewhat yield to such alterations of the humors; and that more or less, according to its different strength in the body, of this or that individual. Nor doth this experiment of the Bottle sufficiently conclude, but that, at least, the compression of the air in our bodies, ought to answer that of the Medium: and indeed, that it doth not, seems to proceed from the internal heat in the humors of Animals, (maintained, as is said in the Chapter of Sanguification)

Sanguification) which is of power sufficient, not only to resist the compression of the tone, or tonical motion of the habit of the body, but that of the medium also. And should the contrary happen, death would inevitably ensue.

7. It may be farther noted, that all bodies (whether men, or other Animals) are not equally affected with the same change or alteration in the Medium; but, as hath been said, proportionably to the strength of the tonical power of each body. And thus it happens, that a person of a Robust Constitution, and habit of body, (whether such naturally, or acquired by much travel and labour) will with less trouble and hazard of his health, endure any notable alteration, or change of Weather or Soil, than another of a finer Texture and composure; and whose tone consequently is not so resistive of the impressions from without, as that of the former. And thus it is easie to conceive, why a person inhabiting neer either of the Poles of the Earth, and removed to, or neer the Equator: or the contrariwise, will find the temper of that Climate more troublesome and

and offensive to his health, than he shall, that from the middle temperate Region, shall transfer himself to either of the extremes. And no doubt, the less the difference is, the easier and sooner shall a mans Nature be brought to comply with it. And thus we observe, that *Spaniards* and *Portugezes*, do with less danger, travel and trade into the more Southern Regions of the world, than Northern men can do, who are commonly not otherwise seasoned, than by some dangerous Calenture, Flux or Spasm, or other deplorable disease, whereby much, the greater part of them, are commonly destroyed. All which diseases are no other, than the effects the Medium hath upon the Air imprisoned in our bodies; which if it finds the humors easily disposed to a farther degree of fermentation, than what is consistent with health, it produces a Fever or Calenture in some bodies; in others, a dangerous Flux: and in some most violent Spasmes, upon the forcible dilatation either of the Air in the nervous parts, or of that, which may possibly be, in the spaces between the Muscles.

8. From hence probably it is, that
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the fruits of those hotter Countryes are so dangerous, especially to strangers; for that they are no sooner received into the body, but they are straightways very violently fermented (and after the same manner ferment the juices of the body, to the disordering of the whole frame) in so much, that the juice of some plants, is accounted a deadly poyson, as that of the Root of *Yucca* (while the solider parts are made into a kind of wholesome bread) and possibly, for no other venomous quality, than its over-active fermentation, whereby it not only disturbs, but destroys the Oeconomy of the body. All which, and much more of this kind, that might be produced, seems in great part to depend upon the fineness, or rarity of the Medium, which lying lighter on liquors, and other bodies thus fermented, suffers them more easily, and more violently, to expand themselves, than, for the most part, is suitable with the health of such as eat them, especially in any considerable quantity.

9. And now from what hath hitherto been said, it may seem exceeding probable, that the Air doth considerably alter, and
dispose

dispose the humors of our bodies, especially upon changing one Clime for another; and that our bodies do, more or less, sympathize with the present tone and temper of the Medium; whereby it is not only freed from several distempers, but may also very often be thereby variously disaffected, and cast into divers dangerous diseases. But yet, how useful soever the changing of the Air may be, for the cure of any infirmity: we find it stands with the convenience but of very few, to make such removals; for that they cannot well dispense, with the leaving their Families or Relations, together with other their familiar affairs, or employments. Besides, Physicians are not apt to advise their Patients to it, till they have first, in vain, employed most other remedies in the cure of them; whereby commonly the opportunity is lost, and the sick person deprived of that benefit he might, in all probability, have received, upon a more seasonable removal. Besides, many times, it would be necessary, not only to remove to some neighbouring place, or other, but even to take a journey of some hundreds of miles, which cannot be performed

formed by the sick, but with great difficulty. So that what through one impediment, or other, the thing happens to be but rarely put in practise; and so Noble a Remedy, is not only neglected, but in a manner brought into disesteem with some, for want of more frequent examples of the great use of it; while they cannot give themselves a satisfactory account, how such a change of the Air should so considerably work upon our bodies.

10. Now to the end we may not want the help of so generous a remedy; and for the better avoiding the fore-mentioned inconveniences in the use of it. I hold it a matter of no small compendium, in this place, briefly to set down, and shew the manner of a certain contrivance, how any person may receive the benefit he may expect, upon removal from his abode, to any other place (with intent to change the air) and that almost indifferently at any season of the year, without so much as removing out of his own house, or neglecting any occasions whatsoever. First therefore, in some fit place neer, or adjoyning to your house, erect a convenient Room, of about
some

some twelve or fourteen foot square, or of what size you please, either bigger or smaller than the former, and let it be exactly well cieled, or vaulted over head, and well paved; or otherwise so floored at bottom, that the air may not have any vent, to get either out, or in, nor yet through the walls, which it is requisite should be of brick or stone, and well plaister'd on the inside; and let the windows be likewise so contrived, that no air may pass in or out that way, which the easier to prevent, and that they may be also the stronger, and less apt to crack, they ought not to be very big, nor many. The door must be likewise so contrived, that it may shut into its frame so exactly, that when it is made fast, there may not be the least passage left for the air to get in or out of the foresaid Chamber. The particular manner and contrivance of doing all which, I do not here set down, for that I doubt not, but there are ingenious Masons and Joyners, that will much exceed any directions, that I can be able to give them. Your Air-Chamber being thus made, you must farther provide your self with a very large pair of Organ Bellows, which

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must

must be placed in some convenient part of the Room, where by the help of a Skrew, the Nose of them may be exactly joyned to a Copper Pipe, whose other end must pass through the wall of the Room, and have a value, opening outward, exactly fitted to it, as is usual in Water Engines: and if the said Value be placed in water, it will do much better. This Brazen Pipe must likewise have another Value to open inward, and both so contrived, that either of them may be set open at any time, or taken off, while the other is imployed. The Bellows being thus fitted, and the door and windows close shut, you may at pleasure either fill the Chamber with Air, by forcing in what quantity you please, till there be twice or thrice as much as there was at first, till the same be as thick as is requisite. You may likewise discharge the Chamber of one third, one half, or more of the air it had at first in it, till you have on the contrary, brought what remains, to that degree of Tenuity (or thinness) is required, and this by the help of the Bellows; which if the air be to be forced out, must lie with their moveable part upwards; and the

the innermost Value of the Brazen Pipe, before mentioned, must either be taken off, or kept constantly open : but if air is to be forced into the Chamber, then the Bellows will need to be turned the wrong side upward ; and the outward Value of the Brass Pipe must be taken off, or kept open, and the innermost Value suffered alone to play. In which cases, working gently with the Bellows, you may either charge, or discharge (as I may say) the Air-Chamber at your pleasure, and consequently, obtain an Air in it, of what rarity or density you please. The measure of which variety, that you may the more exactly take an account of (and that there may be very little or no mistake in the use of this Chamber) it will be absolutely necessary, to have constantly with you, a large Weather-glass : And you may likewise have a Tub of glass, of some forty inches long, filled with Quick-silver, and inverted into a little Earthen or Wooden Vessel, half filled, with a quantity of the same material, after the manner of the Torricellian experiment ; and these are to serve you for Registers : for by the ascent,

and descent of the Water, in the Weather-glass, will be noted to you, by the degrees, on the neck of the Glass, in what proportion you have either rarified or condensed the Air within the Room: and you may by help of it, rectifie the tone of the Air, to what degree is requisite, or enjoyned. The use of the Quick silver Tub, is the very same, but will not give so exact an account, of every small difference, as the former, by reason of the small quantity of Air contained in it: but yet will not want its use in other experiments, not relating to Physick, which I shall not here touch upon, as too remote from what we here handle. Such therefore, as imploy this contrivance, only in Relation to their Health, may content themselves with a Weather-glass, which will prove much an exacter Register, than the Quick-silver Tub, as hath been already shewed.

II. As to the particular application of the use of the newly described Domicilium, or Air-Chamber, 'twill not be amiss to repeat, what we before asserted in the precedent Chapter; namely, that as health itself, is maintained by a due and suitable fermentation

fermentation of the humors in our bodies, and that within a certain latitude. So, if the irregularity of the said motion, or fermentation, be great enough, to become the cause of the manifest abolition, or weakening only, of any action of our bodies, the party so affected, is said to be sick, or diseased: and as all diseases may be divided into acute, whereto are those of short continuance to be referred (though they are not usually termed Acute, taking the word more strictly) and Chronical affections: or else (which comes to the same thing) they may properly enough be divided into diseases, participating of heat, or of cold. The former of which we have already defined, to depend upon such an irregular fermentation of the blood, and Mass of humors, wherein the same are more violently moved, than is consistent with health: of which kind are all continual and intermittent Fevers, all Inflammations, most Fluxes, and several other distempers: and contrariwise, all Chronical, or cold affections, seem to depend upon such an irregularity of the foresaid Fermentation, whereby the humors are not so suffici-

ently moved, and agitated, as is requisite to health; of which kind are the Scurvey, the Rickets, all Dropsies, some Fluxes, most affections of the Spleen, and probably the Gout, and other Arthritical distempers. Now the method of using this Domicil, or Air-Chamber, in general, will be this, that where the disease seems to depend upon a deficient Fermentation of the humors, in such case, the Patient (being put into the said Chamber, and the door close shut) shall, by degrees, discharge the same, or force the air out; till having considerably alter'd the tone, and rarified what remains, he still finds himself to breath freely, or at least with no great difficulty; at what time he may observe, how low the water is descended in his Register, or Weather-glass, which will shew him how far he may safely, at another time, discharge the air, without danger of Cramping; which uses to ensue, if the air be too exceeding'y rarified. On the other side, if the disease be Acute, and seem to depend upon the too violent Fermentation of the humors, then it is necessary the Chamber be well charged with air, to what degree
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of Toleration shall seem convenient. And here we are principally to provide, that no difficulty of breathing ensue, which oftner happens in this practise of condensed, than attenuated air. Now the term of the Patients continuance in the Chamber, at one time, is to be defined in Chronical diseases, as well from his own occasions, as other circumstances; and generally two, three, or more hours, may seem sufficient, and that especially in the morning, when the use of other Remedies are found most conducive. But in acute diseases, it should seem necessary, that the Patient continued in the said Chamber, during the whole course of the disease, and that the tone of the air be prudently altered, after the directions of some able Physicians, according as the times of the disease shall seem to require; especially in intermittent Fevers, where the time of the whole Paroxisme must be spent in the Chamber, and the cold fit requires to be treated as a cold disease, with rarifying the air, as the hot fit, by condensing it, which must be carefully observed. Now though there may be many diseases, as the Stone, the French Pox, and some other, which

which do not depend so immediately, upon the aforesaid irregularities of the Fermentation of the humors ; yet I should not doubt, even in these, to commend the use of this Domicil, or Air-Chamber : for that while Nature is thereby much strengthened in all her Natural Functions , it must needs follow, that she will from hence , at least, be enabled the better to endure the conflict with those diseases, if, at last, she do not wholly get the better of them. It will farther be necessary here to add , that in malignant diseases , and where we require an amendment of the insensible transpiration ; we are, as in cold diseases , to rarifie , and not condense the air in the Domicil , where the Indication is rather preservative , than curative, as Physitians use to speak.

12. To say something of the use of this contrivance, in time of health, we shall only propose it, as a good expedient to help digestion, and especially insensible transpiration, and facilitate breathing and expectoration ; and consequently, as of excellent use , for prevention of most affections of the lungs, where they are feared ; and that generally , what ever the benefits of
changing

changing the air, are, may be reasonably expected from the use of this Domicil ; and that after a more certain regular way , than without it , for that by the means of it , a person may serve himself with such air , as were not otherwise to be found, but on the top of the Pike of Teneriff, or some other very high Mountain : nay , if it were convenient, as perhaps it may in some very contumacious affections , he may rarifie the air to a far higher degree , and make it such, as is not again to be found upon the face of the whole inhabitable world. But as well in sickness, as in health, those great excesses are not to be ventured upon , but by degrees. The use of this Domicil may be farther extended, for preventing the inconvenience which may ensue, upon any great change of air , by travelling into forreign Countreyes ; whereby a person may at pleasure reduce the tone of the air , to that of his own Soil or Climate : and probably , if the same might be made use of aboard Ships, it would (with the additional contrivance of a Chair, or Bed , hung after the manner of a Sea-Compass) prevent that
 very

very trouble affection whereto fresh men are so subject, called Sea-sickness; and consequently, become very serviceable to such, whose employments ingage them to undertake Voyages into very remote parts, and there to reside, far from their own Countreys. There may, I doubt not, several other considerable conclusions be performed, by means of this contrivance: As also, that the thing it self is very capable of good improvement, as to the projection of it, far beyond that described by us. All which, together with what hath been already said, and undertaken by us, on the behalf of it. We leave for farther discovery, and confirmation, to practise and experience.

13. Among the improvements which this contrivance of an Air-chamber is probably capable of, it is in my judgement none of the least that may be obtained, by joyning the practise of *S. Sanctorius*, in his *Medicina Statica*, to this of ours. For as the promotion of the transpiration by the habit of the body (than which, nothing conduces more to the preservation of health, and prevention of diseases) is one of the most considerable

considerable among those many benefits we promise our selves by it : So , if we shall have, as *Sanctorius* directs, a *Statera Romana*, in our Air-chamber , it will be of very great consequence, for ascertaining the Methodical use of it , whereby it will become less subject to guess or hazard. For as the Weather-glass, before-mentioned , will discover to us, the degrees of rarity and density , introduced in the inclosed air : So the Balance, will with the same exactness inform us , at what rate this *Diaphoretical* transpiration, is either improved or abated : and at the same time give us the true weight (in Ounces and Drachmes) of those insensible *Effluvia* , which continually pass that way. For the Patient, weighing himself (for instance) first at seven of the clock in the morning , and again at nine or ten (having first exonerated himself) and abstaining from meat and drink , in the mean time ; shall thereby perceive how much (by weight) of his aliment , or rather of the unprofitable part thereof , in those two or three hours, passed insensibly through the pores of his body. Let him again repeat the same experiment, the day following,

ing, with the same circumstances, in the Air-chamber: and he will not be a little surprized, to find half so much more, and perhaps, twice the quantity evacuated, after the same insensible manner (or *è contra*) and that in such proportion, as he shall have suffered more, or less, of the included air, to have passed into the circumstant Medium, (or *è contra*) of what proportion the Weather-glass, as a faithful Register, shall give him a very particular account. I will not farther enlarge, upon this additional practise, of the Scale or Balance: much less add any thing of the use of insensible Transpiration, least I might offend such, as are better versed in Statical Experiments; by the unprofitable repetition, of what they are already so well acquainted with: or by giving an ill account of a book I have but once read over, and that near twenty years since, deprive others of that solid benefit they may receive, by perusal of the above-commended Treatise of *Sanctorius*.

14. As this contrivance of the air-chamber, is best fitted for the improvement of health, and the abolishing such Morbose Characters,

sters, as depend upon the over-flow, or too nimble fermentation of the Humors. So it were easie to project, great Vessels, after the manner of Cupping-glasses, some capable to receive the whole Thighs, others fitted for the Arms: whereby we may at pleasure, (as the seat of some particular diseases shall direct) make such powerful revulsions, as shall not only be sufficient, to charm, as it were, and dispose of such humors, as Physitians call *Turgid*, and *Motu Peccantes*: but even discharge particular parts of such humors, as have seated themselves there already; and may, besides that of Cupping-glasses, very fitly supply the place of the strongest Ligatures. Which practise, as it may be very available, in most affections of the head: In inflammations, or other tumors or charges, of particular parts: So (not having yet had sufficient opportunity to confirm this my Opinion, by the frequent use of it) I shall content myself at present with having done little more, than named it only.

15. I shall add farther, that the use of this Air-chamber, may in some cases, but after a weaker and more uncertain manner,
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be supplied by a long-setting Swing, which is found to be a very agreeable exercise, by most people that have used it : if their bodies have not been very impure, or first duly prepared. And by it many persons, affected with Chronical distempers, taking their original from a deficient fermentation, have found benefit. For, motion conducting so much (as has been said) to the exciting of all fermentation, (which is visible in Syrups, and other juices of Vegetables shaken, and as a proof of it, that Brandee Wine, is accounted the best, that upon shaking bubbles and works most) no wonder if the seasonable continuance of this moderate, reciprocal motion of the Swing, do by degrees, (though not so suddenly as in the fore-mentioned instances of Syrups, &c. because the humors in our bodies lie not so loosely as they, in Vessels of glass or stone) produce the same effect, we observe without, in other liquors. Nor is the fermentation (or call it concoction) of the humors in their Vessels, hereby only advanced : But likewise the distribution of the first, and second ways, (if I may so call them) is very much promoted : For
still,

still, as the body is carried forward, so often are the Abdominal Muscles, gently and equally compressed, whereby the chyle is the more nimble pretended from the Intestines forward, to mingle with blood. And again, upon the recess of the body, the Abdomen being less compressed, than if the body set still in the same scituation, is more dilated than usually, and consequently receives the chyle flowing, more plentifully from the stomach into the Intestines. So that, if it come faster into the guts, and be driven faster out, it must of necessity follow, that the distribution thereof shall be more readily performed. Now, for what we lately called, the distribution of the second ways, that seems by the use of the Swing, to be improved after this manner: while the body moves forward, as the fore-parts are more compressed by the Medium, so the back parts are less compressed (and thereby, as we may say, their tone weakened) whereby the habit doth not so forcibly resist the afflux of humors flowing to that part: as in its middle, natural, and quiet scituation. And thus reciprocally, first one part, and then the other, are somewhat bet-

ter disposed, for the Reception of their al-
imentary juices, which I call the distribution
of the second ways. And thus much may
suffice to have said at present, concerning
this matter. I shall only desire my Rea-
der, that he will not be over precipitious,
nor let the novelty of our attempt surprize
him to a prejudice: and that he be first,
for his own sake, well assured, he is Master
of those principles, upon which this Fa-
brick of ours (as upon so many goodly Pil-
lars) stands erected; before he proceed to
condemn us. But if upon the serious per-
usal of this Treatise, by such whose Au-
thentick Censure we most value and Reve-
rence, we happen to be found light in our
own Balance: We have at least to plead,
that we have neither mispent much of our
own, or their time in writing, or reading
of it. And that though we failed, the de-
sign was great and Honourable, and dire-
cted to the benefit of mankind, which may
in good part plead our excuse, and their
good favour make out the rest.



FINIS.

